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# Five Fundamentals for the Phone Network Transition

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1. The phone network is transitioning to new technologies. This creates opportunities for better services, but does not change the fundamental needs served by our nation's communications system.

2. The phone network transition is inevitable, but the policy implications of the transition are not.

3. Our nation's communications policy should be set by referring to the basic fundamental values that made our phone network the envy of the world.

4. The nation's telecommunications policies must continue to ensure service to all Americans, competition and interconnection between networks, consumer protection, network reliability, and public safety.

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# Introduction

For decades, the phone network in the U.S. has quietly and reliably provided benefits to the American public. These benefits have become so firmly engrained in the U.S. economy, public safety systems, and personal communications that users take for granted the consumer protections and competition policies that make them possible. These benefits were not a happy accident—they were the result of deliberate communications policies that demanded a telecommunications network that served its users first and foremost. But technical changes to the underlying telecommunications network are putting those policies—and everything that they make possible—in jeopardy.

Even today, on a daily—if not hourly—basis, users enjoy the benefits of the structural protections built around the phone network. We conduct our business and personal communications as if we can always trust that the phone network will just work—because it will. When the power goes out during a natural disaster, landline phones will still be powered through the copper line connecting it to the back-up power of the central office. When someone calls a friend on another phone network, that call will always go through—regardless of which carriers the two users subscribe to or where they each live. When the bill comes for that call, the user can rest assured that there will be no fraudulent charges and the carrier will not have "traded" her to another carrier without her permission. And in the rare instance that any part of this system breaks down, we know that there are government authorities at the local, state, and federal levels equipped to fix the problem and protect users' interests.

Every piece of the world described above exists because of a complex system of laws and regulations that ensure the existence of an accessible, affordable, reliable phone system. This system results in a phone system that operates so effortlessly from the user's perspective, many do not know of the regulatory structure underpinning the network. But they may discover its importance soon. This regulatory structure is now being called into question as carriers shift their networks from traditional time-division multiplexing (TDM) technology to Internet protocol (IP) technology.

As carriers transition their networks to rely on IP technology, rules that have so far relied upon the existence of the traditional, public-switched telephone network (PSTN) may not extend to newer IP-based networks. This is true even though the offering of basic phone service remains largely unchanged from the user's perspective and users' expectations of the benefits that come along with "phone service" remain the same.

The transition of the PSTN involves many technical and policy issues. These will be impossible to navigate in any coherent way without a basic framework. The framework will lay out the fundamental values that underlie our communications networks and use them to guide policy proposals going forward. This paper puts forward the framework of Five Fundamentals that underlie our phone network: service to all Americans, interconnection and competition, consumer protection, network reliability, and public safety. These principles have motivated communications policy for the past 100 years, and continue to serve the same basic social goals that they have always served, even as the technology used to achieve them changes.

## Why Do We Need a Framework?

What makes a framework so important to the success of this transition? Everyday, it seems, old technologies pass away as new technologies replace them. What makes the phone network, and the broadband network on which it rides, different? Given the clear benefit many of us already enjoy from these new technologies that are rapidly replacing the traditional phone system, why does the framework matter?

The best way to answer this is to look at some of the problems we have already confronted early in the transition. While no one doubts the potential of these new technologies to make a positive difference in our lives, few have considered what problems and disruptions will occur when a system the nation has relied on for 100 years undergoes a dramatic change. In the last year, users have discovered that many of the features they took for granted in the old copper network do not apply to the cell phones and IP-based networks replacing it.

When Hurricane Sandy wiped out power for much of the Northeast United States. Last year, many residents found themselves unable to communicate because wireless and cable networks, unlike the old copper network, are not self-powered.[1] As we move forward with the IP transition, should authorities tell consumers that they can no longer rely on their phone system in an emergency? Should we have some sort of back-up power for the new networks, accepting that this will raise cost?

Calls from new IP-based systems do not always reach people in rural areas.[2] Should we care? On the one hand, the inability of people in these rural places to receive phone calls reliably has a potentially devastating impact on their ability to conduct business and maintain connections with others throughout the country. On the other hand, is it appropriate to impose significant regulation and cost on major carriers to resolve problems for a very small percentage of calls to a very small percentage of subscribers?

On Fire Island, New York and in Mantoloking, New Jersey, Verizon has asked for permission to replace copper lines damaged by Hurricane Sandy with a wireless service called "Voice Link."[3] Voice Link does not currently offer many features the previous copper voice service did. It does not work with Life Alert or security systems. It does not allow subscribers to receive collect calls or use international calling cards. The service does not provide the same voice quality as copper, and is not guaranteed to reliably reach 9-1-1.[4]

Does Verizon have a responsibility in Voice Link to support all the services that its old copper line supported? If not, what responsibility does it have to people who had held on to their copper service (rather than simply rely on cell phones or switch to a non-traditional provider, such as cable) because they valued these services? Are those users on their own? What happens in communities across America as floods, tornados, hurricanes, and other natural disaster wipe away the old copper lines and the phone companies want to replace them with new services?

While technology informs the answers to these questions, technology does not tell us how to answer them. As these problems and new issues yet unforeseen emerge, people and policymakers will need a set of principles to guide their answers. Whether it is the Five Fundamental Principles set out in this framework, or some other set of principles, we need a consistent guide to tell us how to answer the real world problems.

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[1] *See* David Gabel and Steven Burns, *The Transition from the Legacy Public Switched Telephone Network to Modern Technologies,* National Regulatory Research Institute, at 17 (Oct. 2012).

[2] *Rural Call Completion*, WC Docket No. 13-39, Notice of Proposed Rulemaking, ¶ 1-3 (2013).

[3] Section 63.71 Application of Verizon New York Inc. and Verizon New Jersey Inc. for Authority to Act Pursuant to Section 214 of the Communications Act of 1934, as Amended to Discontinue the Provision of Service (filed June 7, 2013).

[4] Verizon Voice Link Terms of Service (June 10, 2013).

We cannot, and should not, demand that companies keep the same copper-based technologies forever. But we also should not assume that the new world will automatically be just as good or better. It can easily be a step backward, as well as a step forward. As we shall see, there was nothing magic about copper that gave us the basic principles of service to all Americans, competition, consumer protection, reliability, and public safety. Rather, deliberate policy choices were responsible for creating the national 9-1-1 system or making sure that everyone had affordable phone service. If we make a different set of choices now, we could easily leave these and other things we associate with the phone system behind.

## The Transition Is Inevitable, but Its Policy Implications Are Not

The transition of the phone network is already happening.[5] After all, carriers have business and technical incentives to upgrade their networks to IP-based technology, and they are responding accordingly. In fact, in recent months we have seen AT&T announce its intentions to replace its TDM- and copper-based service with a wireless-only voice product,[6] while Verizon is actively replacing its wireline TDM-based offerings with a fixed wireless product in towns damaged by Hurricane Sandy and surrounding areas.[7]

### This Is Not a Bribe to Carriers but a Debate About Our Future

This fact that carriers are already eager to transition has two implications. First, there is no need for regulatory concessions to motivate carriers to make upgrades that they are already certain to implement. Removing any part of the regulatory framework consumers depend upon for reliable, functional, reasonably-priced phone service in hopes of incentivizing companies to upgrade a network they will already upgrade is not merely a bad bargain; it trades something potentially valuable to the community for something the carriers are already doing anyway.

This is not to say that states (and the federal government) should not take this important moment in time to review which laws and policies make sense and which do not. For example, laws that assume a rate-regulated monopoly provider can provide affordable service to rural areas as a "carrier of last resort" may not make sense where providers now have competition in the wealthier markets that used to fund deployment in these high-cost areas. But simply eliminating the old rules as obsolete may well mean that these communities see the quality of their phone service plummet as deregulated carriers no longer pay to keep their networks in good repair.

### A Conversation About Values Rather Than Rules

Second, there is a need for a thorough and thoughtful conversation to determine the implications of the network transition. The physical infrastructure and technologies of the phone network are being upgraded, but the essential functions of the network are not radically changing. The use of IP-based technology alters in some ways the configuration and structure of the network, but at its core the upgrade is simply a new way to achieve the same service.[8] It follows that there is no principled reason using a different technology to deliver the same service should result in radically different policy goals for the network as a whole.

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[5] *See* Samantha Bookman, *Verizon Voice Link for Fire Island Approved by NY Commission*, FIERCETELECOM (May 20, 2013), http://www.fiercetelecom.com/story/verizon-voice-link-plan-fire-island-approved-ny-commission/2013-05-20; Joan Engebretson, *Wireless Landline Replacement is Part of AT&T's Rural Plans*, TELECOMPETITOR (Nov. 15, 2012), http://www.telecompetitor.com/wireless-landline-replacement-is-part-of-atts-rural-plans/; Joseph Gillan and David Malfara, *The Transition to an All-IP Network: A Primer on the Architectural Components of IP Interconnection*, Nat'l Regulatory Research Institute (May 2012); Critical Legacy Transition Working Group, Sun-Setting the PSTN, Federal Communications Commission (Sept. 2011).

[6] Joan Engebretson, *Wireless Landline Replacement is Part of AT&T's Rural Plans*, TELECOMPETITOR (Nov. 15, 2012), http://www.telecompetitor.com/wireless-landline-replacement-is-part-of-atts-rural-plans/.

[7] Samantha Bookman, *Verizon Voice Link for Fire Island Approved by NY Commission*, FIERCETELECOM (May 20, 2013), http://www.fiercetelecom.com/story/verizon-voice-link-plan-fire-island-approved-ny-commission/2013-05-20.

In any event, the ultimate functionality of the post-transition network will ultimately be the result of the policy judgments made by those who oversee the network, and the values upon which they base those judgments. Aspects of the network like reliability, interconnection, and back-up power supply are not foregone conclusions dictated by technology—they are the result of policy decisions that will influence providers and shape the nature of the service that eventually reaches consumers.

## How Did We Get Here? The History of the PSTN

As we look to what values should guide the transition forward, we should carefully consider what values guided us on the old network. We should consider these not merely because they have shaped our national expectation on how our communications networks should work, but because of the incredible success of the network that was built on these principles.

For decades now, the PSTN's penetration rate into more than 90% of U.S. homes and businesses made it one of the national "systems of record" for enabling communications across the nation.[9] Indeed, the new networks that have evolved, the Internet and the cell phone network, emerged out of the old communications network thanks to a series of policy decisions that made the ubiquitous traditional telephone network an open and reliable platform for everyone to use.[10]

In addition, policies like universal service have created a positive feedback loop by maintaining the central position of the PSTN to the communications infrastructure and reinforcing the importance and universality of the PSTN.[11] This history has built a series of networks that lie at the heart of the U.S.'s economy and culture. An examination of what policies created such success in the traditional phone network will help inform what policies we need to implement as the network transitions to its next iteration.

### How the U.S. Phone Network Became the Envy of the World

At the turn of the 20th Century, AT&T had gained increasing dominance in local and long distance telephone service. One of AT&T's main business strategies was to refuse to interconnect its long distance network with independent local telephone carriers. This prevented independent carriers from offering a comprehensive service to consumers, making it difficult for AT&T's competitors to attract or keep any customers. When the independent carrier could no longer sustain its business AT&T would buy the company, thus increasing its leverage against other remaining competitors and giving it a monopolistic position in the market.

In 1913, the U.S. filed an antitrust lawsuit against AT&T to break up its growing monopoly in the phone service market.[12] While Congress contemplated nationalizing the long distance telephone network, AT&T settled the U.S. government's antitrust lawsuit with the Kingsbury Commitment.[13] In the Kingsbury Commitment, AT&T agreed to allow independent local telephone companies to interconnect with AT&T's long distance network, divest Western Union, and refrain from purchasing other companies if the Interstate Commerce Commission objected.

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[8] *See* Appendix for a more detailed description of the technological changes involved in the upgrade from a TDM-based to IP-based network.

[9] Critical Legacy Transitions Working Group, *Sun-Setting the PSTN*, Federal Communications Commission (Sept. 2011).

[10] Jason Oxman, *The FCC and the Unregulation of the Internet,* Federal Communications Commission Office of Plans and Policy, at 3, 15-16 (1999). See also H.R. REP. No. 103-213, at 409-10 (1993) (Conf. Rep.), reprinted in 1993 U.S.C.A.N.N. 1088, 1181-82.

[11] *Id.*

[12] See Milton Mueller, *Universal Service: Competition, Interconnection and Monopoly in the Making of the American Telephone System* 129 (MIT Press 1997).

[13] Letter from Nathan Kingsbury, AT&T Vice President (Dec. 19, 1913).

Under the Kingsbury Commitment, AT&T did impose an access charge on independent carriers and would not interconnect its local exchange with an independent carrier's local exchange, but the Commitment nevertheless became one of the first actions underscoring the importance of interconnection to enabling competition among communications networks. Federal law subsequently recognized the importance of interconnection by requiring carriers to physically connect with one another,[14] and later detailing the interconnection obligations of telecommunications carriers.[15]

Thus, through smart policy decisions guided by the basic principle of interconnection, competition, and consumer protection, the government seized on the opportunity provided by the PSTN to create a telecommunications infrastructure that became the envy of the world. The core public interest features of the PSTN that exist now are not inherent physical characteristics of the materials used to build out the network or the protocols used on them, but rather are the result of policy decisions and rules that established the minimum public interest protections that society expected from carriers.

## The First Major Transition: From Natural Monopoly to Competition

The Communications Act of 1934 continued to maintain rules to protect consumers and ensure a well-functioning network even after the Kingsbury Commitment had broken AT&T's monopoly power in the market. For decades, communications law recognized that competition policy was just one important part of a complex system that must guarantee certain minimum protections to subscribers, especially when society could not rely on competition to incentivize those protections.

Initially, many of the fundamental values in the network, such as reliability and service to all Americans, were financed by a "natural monopoly" system. Every place in America had a local monopoly phone company, usually "Ma Bell" but not always, and that phone company had a monopoly on service in the area. The high cost of maintaining a reliable system, of providing affordable service, and other critical aspects of the system were paid for by charging high prices for long-distance and in other ways under a regulated rate of return.

As technology changed, it became clear that some aspects of the phone system, such as long distance, could sustain more than one provider. Companies like Microwave Communications, Inc. (better known as MCI) offered lower rates and innovative new services if allowed to enter the long distance market. Would be wireless providers offered new cellular technologies that would allow not just mobility, but competition for local service. In a series of actions in the 1980s and early 1990s, most importantly the break up of the AT&T Bell Monopoly into the "Baby Bells" in 1984 and the introduction of spectrum auctions by act of Congress in 1993, we introduced competition as a critical fundamental principle for our communications networks.

At the same time, we took great care to ensure that this transition from natural monopoly to competition did not undermine the traditional values of service to all Americans, consumer protection, reliability, and public safety. Both the states and the federal government introduced innovations such as a separate Universal Service Fund to finance low cost service to rural communities and to the poor. We also transitioned the 9-1-1 network to a national network that would operate on the new, competing networks everywhere in the United States.

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[14] Communications Act of 1934, Pub. L. No. 416, § 201(a) (1934).

[15] Telecommunications Act of 1996, Pub. L. No. 104-104, § 101(a), 110 Stat. 56 (codified at 47 U.S.C. § 251(a)).

In some cases, old tools found new uses. Previously, interconnection requirements primarily ensured that one local monopoly provider reliably connected to another one to guarantee service to all Americans. As we introduced new competitors, interconnection proved to be the most important tool for policymakers to promote competition. A requirement to interconnect with any device that did not harm the network gave consumers their first choice of telephone equipment in the history of the phone network—as well as creating new innovations like answering machines and fax machines. Requirements to allow "electronic publishers" and other "enhanced service providers" to interconnect with and use the telephone network created a universe of new services that relied on the phone system, such as burglar alarms, medical alert systems, and voice mail.

Ultimately, the combination of these rules created the dial-up modem and the Internet. The seeds of the new networks of today were planted by the fundamental values guiding the development of the PSTN.

More recent actions to promote competition, like the Telecommunications Act of 1996's efforts to encourage facilities-based broadband competition, have only demonstrated that there is no guarantee that deregulation will lead to new competition, and competition in turn does not necessarily ensure all of the consumer benefits we have come to expect from basic phone service. Given this, it is crucial that policymakers not find themselves deregulating to the point where we are left with an even more consolidated market with no rules creating a minimum level of service and protection for users.

## Weaker Policies for Newer Networks: Voice-Over-IP, Cable, and Wireless Rise and Thrive on the "Copper Safety Net."

As expected, the introduction of competition created new providers of voice service. The FCC (and states) then faced a question. Should regulators apply the same principles and rules to the new networks? If not, what basic principles should replace the old social contract that had guided the development of the traditional phone network?

Unfortunately, the FCC chose to duck this hard question in favor of ad hoc decisions with no guiding framework and no consistent principles. Invariably, providers of new technologies argue for a variety of reasons that the FCC should exempt their particular service or technology from the existing rules to encourage development, even if the principles underlying the existing rules seem to apply to the new technology with equal force.

Unsurprisingly, the result is an inconsistent hodge-podge that has segregated nearly all critical policy obligations to the "copper safety net" of the traditional phone system. For example, in 2004, Vonage asked the FCC to classify VoIP service as an information service under Title I of the Communications Act and pre-empt the Minnesota Public Utilities Commission from applying phone regulations to Vonage's interconnected VoIP service. The FCC preempted the Minnesota PUC order, but did not classify interconnected VoIP as either a telecommunications or information service.[16] Meanwhile, the FCC issued a decision affirming that AT&T's traditional copper-line system that included a VoIP component in the middle remained a traditional phone service.[17] VoIP provided by cable services, so called "interconnected" but "non-nomadic" VoIP, remained entirely unclassified for regulatory purposes.

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[16] *Vonage Holdings Corporation Petition for Declaratory Ruling Concerning an Order of the Minnesota Public Utilities Commission*, WC Docket No. 03-211, Memorandum Opinion and Order, 19 FCC Rcd. 22,404 (2004).

[17] *Petition for Declaratory Ruling that AT&T's Phone-to-Phone IP Telephone Services are Exempt from Access Charges*, WC Docket No. 02-361, Order (2004).

As a result of these conflicting decisions, interconnected VoIP—phone service that happened to not use TDM technology, but traded calls with TDM-based networks on the PSTN—was considered generally unregulated. The FCC has, however, applied some rules to interconnected VoIP providers in various proceed ings through the Commission's ancillary authority and § 706.[18] And so, today the limited number of regulations that apply to VoIP are based upon ancillary authority.[19] This ancillary authority, of course, assumed the existence of a traditional phone network. It remains unclear what happens to that authority if the PSTN "disappears" as part of the transition.

## Policy Choices Not Legally Compelled

It should be noted that there is no legal necessity for the FCC to treat VoIP differently than other types of phone service. After all, the 1996 Telecommunications Act very explicitly defined telecommunications service "regardless of the facilities used."[20] Neither the regulatory definition of "telecommunications"[21] nor the definition of the "public switched network" require that the service or network rely upon a particular technology, much less a TDM-based infrastructure.[22] Instead, both terms are defined by the type of service that is actually being provided, regardless of the technology the carrier uses. This gives the FCC ample room—even if it has thus far declined to use it—to classify managed VoIP services as telecommunications services and rely upon its broad authority under Title II to ensure the post-transition PSTN provides the same basic public benefits the phone network has always provided.

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[18] *See Universal Service Contribution Methodology*, Report and Order and Notice of Proposed Rulemaking, 21 FCC Rcd. 7,518 (2006), *aff'd in relevant part sub nom*., *Vonage Holdings Corp. v. FCC*, 48900 F.3d 1232 (D.C. Cir. 2007) (creating universal service contribution requirements for interconnected VoIP providers under ancillary authority); IP-Enabled Services, WC Docket No. 04-36, WT Docket No. 96-198, CG Docket No. 03-123, CC Docket No. 92-105, Report and Order, 22 FCC Rcd. 11,275, 11,283-291, ¶ 17-43 (2007) (extending disabilities access requirements to interconnected VoIP under ancillary authority); *Telephone Number Requirements for IP-Enabled Services Providers; Local Number Portability Porting Interval and Validation Requirements; IP-Enabled Services; Telephone Number Portability; CTIA Petitions for Declaratory Ruling on Wireline-Wireless Porting Issues; Final Regulatory Flexibility Analysis; Numbering Resource Optimization*, Report and Order, Declaratory Ruling, Order on Remand, and Notice of Proposed Rulemaking, 22 FCC Rcd. 19,531 (2007) (extending local number portability requirements to interconnected VoIP providers under ancillary authority); *Implementation of the Telecommunications Act of 1996; Telecommunications Carriers' Use of Customer Proprietary Network Information and Other Customer Information; IP-Enabled Services*, Report and Order and Further Notice of Proposed Rulemaking, 22 FCC Rcd. 6,927 ¶ 54 n.170 (2007), *aff'd sub nom*. *Nat'l Cable & Telecom. Ass'n v. FCC,* 555 F.3d 996 (D.C. Cir. 2009) (extending CPNI rules to interconnected VoIP service under ancillary authority).

[19] The FCC's authority to pursue public safety objectives in IP-based networks is strengthened by the NET 9-1-1 Improvement Act of 2008, although this may result in moving one piece of the puzzle ahead while the rest of the fundamental principles underlying the phone network remain overlooked.

[20] Telecommunications Act of 1996, Pub. L. No 104-104 § 3(a)(2), 110 Stat. 56 (codified at 47 U.S.C. § 153(53)).

[21] 47 U.S.C. § 101(50) ("The term 'telecommunications' means the transmission, between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent and received.").

[22] 47 C.F.R. § 20.3 ("Any common carrier switched network, whether by wire or radio, including local exchange carriers, interexchange carriers, and mobile service providers, that use the North American Numbering Plan in connection with the provision of switched services.").

### New Circumstances Require Re-Examining Old Decisions

The FCC decisions deliberately avoiding traditional classification and regulation of the new IP-based networks and (to a lesser degree) wireless networks generally had two affirmative policy rationales in addition to the general political calculus to avoid controversial decisions. First, the FCC expressed concern that application of traditional telecommunications rules would discourage investment and deployment. Second, the FCC expressed concern that "legacy regulations" were not suitable for new technologies. Against the background of all these decisions, however, remained the knowledge that the traditional telephone network continued to provide a necessary backstop for our important fundamental principles.

No longer. As we pull up the copper safety net behind us, the FCC must seriously consider not whether additional services must also provide service to all Americans, for example, but whether we will require service to all Americans at all. If no one is required to provide service, and if universal service subsidies cannot provide adequate incentive, then we must accept as given that our commitment to service to everyone is dead.

The same is true for every other fundamental principle. The question is not simply whether the "old rules" apply to the new networks. The question is whether we continue to believe in the same basic social contract between our society and our communications networks.

By ignoring the authority available to it, the FCC has permitted managed VoIP services to develop without the core public interest principles that made the traditional PSTN such a success. Fortunately, the existing TDM-based PSTN has provided a backstop to assure that the larger phone network continues to operate as expected. However, as the PSTN transitions to an IP-enabled network, the older infrastructure that the FCC has always relied upon to cover for its regulatory shortcomings will no longer be around to guarantee the critical characteristics users have come to depend on. The FCC must develop a coherent framework to guide it through this transition.

## The Five Fundamentals: A Framework for the Phone Network Transition

A basic framework is necessary to evaluate the many proposals that have been put forward before federal, state, and local regulators regarding the transition of the PSTN. After all, it is impossible to know how to respond to an idea without some sense of what goals or values the idea is supposed to serve. In the case of the PSTN upgrade, authorities can rely upon the principles establishing the Social Contract that has served the PSTN so well for decades, and recast that Social Contract in light of the opportunities and challenges presented by new technology.

Going forward, the Five Fundamentals framework can be used to address concrete examples of need: regulators may examine where the Five Fundamentals are not being met or are at risk of not being met under current rules. This type of framework emphasizes that certain basic needs must be met if users are to expect the same benefits from the phone network that have encouraged commerce and communications in this nation for decades. This recasts the issue from a question of what can be done to a question of what must be done. The FCC must assure that privacy, truth-in-billing, and other consumer protection requirements continue to exist regardless of the underlying technical specifications of the network. We must not simply assume that we must lower our expectations for the fundamental reliability of the network. These are policy choices, not foregone technological conclusions, and the realities of the infrastructure we rely upon will depend on the values we ascribe to it now and the social needs we commit to serving throughout the transition.

## Service to All Americans

First and foremost, our national communications policy aims to ensure the benefits of communications technologies flow to all Americans – regardless of "race, color, religion, national origin, or sex."[23] We have, as a nation, decided to invest in a world-class communications infrastructure and so we should, as a nation, reap the benefits of that infrastructure. The principle of service to all Americans applies whether users live in rural areas or urban areas. It applies to those with any physical disability that would interfere with communication. It applies to all users regardless of their level of income. The efforts made pursuant to the goal of service to all Americans will include initiatives that go beyond traditional concepts of deployment and take advantage of the opportunities presented by new technologies.

Whatever happens, the United States must not be the first industrialized nation to retreat from the goal of achieving 100% penetration of basic voice service. While the nation has not yet achieved the goal of 100% build-out, it is vital that reaching everyone in the country continues to be the goal motivating all stakeholders to continue working until the job is truly done.

This is also an opportunity to look forward: what new opportunities are made possible by new technology, and how does that impact what we determine to be the "basic service" that all should have access to? Communications law specifies that universal service encompasses "an evolving level of telecommunications services" and that the FCC should take into account "advances in telecommunications and information technologies and services" as it decides what universal service will look like for homes, schools, libraries, and health care providers across the country.[24] Access to basic communications services reaps tremendous social and economic benefits to users, regardless of the material or technology used to transport the communications.

This principle also entails a number of policies and rules designed to ensure the U.S. continues its goal of providing service to all Americans, including through carriers of last resort and rural build-out. Achieving service for all Americans also requires policies that ensure technology is deployed and is made truly accessible to traditionally marginalized communities in order to bring the social benefits of new technologies to those communities. This should include more than traditional anti-redlining rules.

Currently, the FCC's Connect2Compete program[25] and merger conditions requiring Comcast to make affordable broadband available to low-income users[26] are two examples of relatively recent efforts to promote adoption. While not perfect by any means,[27] these efforts represent a recognition that the public interest for the 21st Century goes beyond traditional concepts of deployment.

It remains to be seen how the U.S. will continue to pursue the goal of 100% basic service for all Americans—regardless of location, income, or disability—as carriers stop maintaining their older, TDM-based facilities. Similarly, state carrier of last resort policies must be able to continue ensuring that all users are able to purchase reliable voice service under nondiscriminatory terms. These policies traditionally applied to all relevant carriers operating in some way on the traditional PSTN. Neither the make-up of the physical plant nor the protocols used to transport data on the network diminish consumers' need for basic service—if anything, advances and new efficiencies in technologies may justify raising the standard for what is considered basic service.

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[23] 47 U.S.C. § 151.

[24] 47 U.S.C. § 254(c).

[25] Connect2Compete, http://www.connect2compete.org/.

[26] *Applications of Comcast Corporation, General Electric Company and NBC Universal, Inc. for Consent to Assign Licenses and Transfer Con*

[27] *See* Amy Chozick, *Mixed Response to Comcast in Expanding Net Access*, N.Y. Times (Jan. 20, 2013), http://www.nytimes.com/2013/01/21/business/media/comcast-internet-essentials-brings-access-to-low-income-homes.html.

Of course, in achieving this goal the FCC's current refusal to classify VoIP service will eventually hit center stage. The FCC has in the past relied upon its ancillary authority under Title I of the Act to create universal service contribution obligations for interconnected VoIP providers,[28] but has not made VoIP services eligible for funding for universal service. Although the FCC applied contribution obligations on interconnected VoIP providers for calls that did not actually touch the PSTN, it based its decision on the fact that interconnected VoIP services in general still offer the capability of reaching the PSTN.[29] This logic will become increasingly untenable as the PSTN moves to a system that looks more like interconnected VoIP than it does like the traditional PSTN—unless the FCC updates its understanding of what constitutes the PSTN.[30]

Similarly, in 2007 the FCC relied upon ancillary authority and its Title II jurisdiction[31] to extend disability access requirements to interconnected VoIP providers and to manufacturers that design interconnected VoIP equipment. These requirements included requiring interconnected VoIP providers to contribute to the Interstate Telecommunications Relay Services fund and to offer 7-1-1 abbreviated dialing for relay services.[32] But for these obligations to function, there must at some point be an actual Title II telecommunications service upon which to base ancillary authority. In considering this issue, the FCC will need to be mindful of the continued need for disability access services and rules in the post-transition PSTN.

One of the most important goals of communications policy in the United States is reaching universal service for all Americans across the country. The transition of the PSTN is an opportunity to expand and improve the communications service that all Americans receive, and our communications authorities must determine how they can continue to serve that goal as the traditional make-up of the PSTN changes.

## Interconnection and Competition

Interconnection and other competition policies lie at the heart of the development of a robust and competitive phone service environment. As we saw more than 100 years ago, without mandatory interconnection the phone network will slide inevitably toward monopoly as the largest carriers can gain anticompetitive advantages by withholding access to their customers from competitors. As carriers now move toward all-IP networks, regulators must determine how they will achieve interconnection and competition among providers post-transition. These policies are critical to creating and maintaining a functioning interconnected network and a competitive market for communications services.

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[28] *Universal Service Contribution Methodology*, Report and Order and Notice of Proposed Rulemaking, 21 FCC Rcd. 7,518 (2006), *aff'd in relevant part sub nom.*, *Vonage Holdings Corp. v. FCC*, 489 F.3d 1232 (D.C. Cir. 2007) (creating universal service contribution requirements for interconnected VoIP providers).

[29] *Id* at ¶ 36.

[30] In this regard, nothing in the current regulatory definition of "public switched network" precludes the inclusion of VoIP services on the network. *See* 47 C.F.R. § 20.3.

[31] *See* 47 U.S.C. § 225(b)(1).

[32] *P-Enabled Services*, WC Docket No. 04-36, WT Docket No. 96-198, CG Docket No. 03-123, CC Docket No. 92-105, Report and Order, 22 FCC Rcd. 11,275, 11,283-291, ¶ 17-43 (2007).

## Interconnection and IP-to-IP Peering Disputes

As discussed above, the duty to interconnect first arose as a means of ensuring service in rural areas in the days of the old AT&T monopoly when rural cooperatives, municipalities, and local businesses brought service to places AT&T found too expensive to serve. Later, as amendments to the Act shifted national policy from regulated "natural monopoly" to encouraging competition among competing networks, interconnection became the sine qua non of fostering and developing competition. Unless we propose to return to the days of regulated natural monopoly, regulators must absolutely guarantee that competing networks will continue to accept each other's traffic and terminate each other's calls in a manner that both preserves call quality throughout the country and actively promotes a robust and competitive environment.

In particular, subscribers to different networks must not find themselves the victims of "peering disputes" that cut off communications and vital services. If NBC and AT&T have a retransmission dispute and AT&T video subscribers temporarily lose NBC programs, it is annoying. But if Comcast and AT&T have a "peering dispute" and millions of AT&T wireless customers can't call Comcast landlines, it is a communications disaster. It is not enough to speculate that incentives will prevent such a thing from occurring. The relevant agencies must retain adequate authority to make sure that such an event continues to be impossible after the transition.

It is not simply idle speculation to imagine this happening to a post-transition PSTN. Already, some carriers are refusing to file IP-to-IP interconnection agreements at the state level.[33] Without adequate interconnection requirements, consumers may find themselves suffering from interconnection disputes between carriers that provide not just their video and internet access, but their basic voice service as well. And if the interconnections that have tied together our voice network unravel, dominant service providers will be able to leverage their customer bases against competitors and control increasingly large shares of the market, resulting in higher prices and fewer choices for consumers.

The Communications Act imposes upon telecommunications carriers "the duty to interconnect directly or indirectly with the facilities and equipment of other telecommunications carriers."[34] But it remains unsettled what this obligation would really mean in a world where the FCC has treated broadband service as an information service and declined to classify interconnected VoIP at all.

Interconnection and competition policy also require an examination of potential reform in call termination and access charges. Rate-of-return carriers that serve rural areas and rural customers have reported increasingly poor phone service quality and increasingly frequent customer complaints.[35] This quality decay prevents small businesses from offering prompt service, threatens to hinder emergency calls to or from public safety officials, and thwarts customers' efforts to communicate with loved ones. These complaints should be taken as a warning of things to come if interconnection requirements are not adequately implemented and enforced in the post-transition PSTN.

This also demonstrates how technological transitions will inevitably result in unforeseen complications, which highlights the importance of having authorities equipped and ready to gather information about the problem and resolve it with minimal disruption to consumers. A transition of this magnitude and level of complexity will inevitably result in service problems that may not be the fault of any one actor, but must nonetheless be assessed and dealt with in a timely manner by competent authorities.

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[33] *See Petition for a Determination that Verizon IP-to-IP Interconnection Agreements Must Be Filed for Review and Approval and for Associated Relief*, D.T.C. No. 13-2, Commonwealth of Massachusetts Department of Telecommunications and Energy.

[34] 47 U.S.C. § 251; *see also* 47 U.S.C. § 201(a).

[35] *Developing an Unified Intercarrier Compensation Regime, Establishing Just and Reasonable Rates for Local Exchange Carriers*, CC Docket No. 01-92, WC Docket No. 07-135, Declaratory Ruling, ¶¶ 1-2 (W.C.B. 2012).

### Policies to Preserve Competition Among Carriers

The transition of the PSTN also calls into question the future of other rules and policies designed to encourage competition in the telephone service market. For example, local number portability (LNP) obligations have currently been extended to VoIP providers so that VoIP customers may keep their North American Numbering Plan (NANP) telephone number when changing providers.[36] LNP rules encourage competition by allowing consumers to respond to providers' price and service changes without losing their phone numbers. But in extending LNP rules to VoIP, the FCC again relied upon its ancillary authority and statutory authority over the North American Numbering Plan and over telecommunications carriers. At this juncture the question inevitably arises: when the traditional PSTN is gone, what will happen to the NANP? How will the FCC sustain LNP rules to all phone service providers without revisiting the foundation of the NANP or classifying VoIP service?

As the PSTN transitions to new physical facilities and IP protocols, it is critical to the competitive future of the market that the law and rules ensure carriers will continue to interconnect and rules will continue to promote competition in the marketplace to the benefit of consumers.

Of course, some of the issues that fall under the umbrella of interconnection and competition will also be relevant to the other fundamental principles discussed in this paper, such as network reliability and consumer protection. This is no accident: the critical issues and questions raised in each of these broad categories are part of a complex system of interdependent parts. Any one social need can implicate multiple categories, and each category attends to multiple social needs.

## Consumer Protection

Competition does not guarantee consumer protection. From the privacy of phone calls to truth-in-billing to slamming and cramming, Americans rely on a web of regulation to provide adequate protection when they communicate with one another. Throughout and after the PSTN transition, consumers must continue to be adequately protected—including effective recourse for the timely resolution of complaints. Consumer protection, truth-in-billing, and privacy principles must continue to ensure that the rules governing our communications networks respect the basic rights of consumers and prevent predatory practices by service providers.[37]

Section 222 of the Act safeguards consumer privacy by imposing upon every "telecommunications carrier" the obligation to protect the confidentiality of its customers' proprietary information.[38] The FCC has extended those rules to apply to interconnected VoIP providers as well, noting specifically: "[w]e emphasize that interconnected VoIP service offers the capability for users to receive calls from and terminate calls to the PSTN."[39]

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[36] *Telephone Number Requirements for IP-Enabled Services Providers; Local Number Portability Porting Interval and Validation Requirements; IP-Enabled Services; Telephone Number Portability; CTIA Petitions for Declaratory Ruling on Wireline-Wireless Porting Issues; Final Regulatory Flexibility Analysis; Numbering Resource Optimization*, Report and Order, Declaratory Ruling, Order on Remand, and Notice of Proposed Rulemaking, 22 FCC Rcd. 19,531 (2007).

[37] *See* 47 U.S.C. § 202(a) ("It shall be unlawful for any common carrier to make any unjust or unreasonable discrimination in charges, practices, classifications, regulations, facilities, or services for or in connection with like communication service, directly or indirectly, by any means or device, or to make or give any undue or unreasonable preference or advantage to any particular person, class of persons, or locality, or to subject any particular person, class of persons, or locality to any undue or unreasonable prejudice or disadvantage."); 47 U.S.C. § 201(b) ("All charges, practices, classifications, and regulations for and in connection with such communication service, shall be just and reasonable, and any such charge, practice, classification, or regulation that is unjust or unreasonable is hereby declared to be unlawful.").

[38] 47 U.S.C. § 222.

[39] *Implementation of the Telecommunications Act of 1996; Telecommunications Carriers' Use of Customer Proprietary Network Information and Other Customer Information; IP-Enabled Services, Report and Order and Further Notice of Proposed Rulemaking, 22 FCC Rcd. 6,927 ¶ 54 n.170 (2007), aff'd sub nom. Nat'l Cable & Telecom. Ass'n v. FCC, 555 F.3d 996 (D.C. Cir. 2009).*

The FCC's Customer Proprietary Network Information (CPNI) obligations currently extend to calls that do not actually touch the PSTN, so long as those calls are made through interconnected VoIP providers.[40] In extending these rules to calls that do not actually run over the PSTN, the FCC returned to its ancillary authority and reasoned that it "continue[s] to believe that consumers have a reasonable expectation that such services are replacements for 'regular telephone' service."[41]

The FCC also currently protects users by enforcing slamming rules that prevent carriers from switching subscribers' services without permission.[42] However, the FCC has explicitly stated that its slamming rules do not cover VoIP providers.[43] Similarly, the FCC has announced that it does not apply its cramming rules that prevent carriers from adding unauthorized charges to customers' phone bills to VoIP or commercial mobile radio service providers.[44] The FCC noted that it declined to extend cramming rules to VoIP providers in part because it had not received enough complaints of cramming on VoIP services, which suggests that cramming rules will surely become necessary for VoIP providers as more and more customers are moved from TDM-based phone services to VoIP or other IP-based phone services.

The FCC's past refusal to classify interconnected VoIP and its past claim of authority over interconnected VoIP solely by virtue of its authority over the traditional PSTN must not prevent consumers from being protected while using what is simply an upgraded version of telephone service. As the PSTN begins to transition to IP protocols and other upgraded technologies, regulators must come to terms with how they will continue to protect consumers post-transition. All signs indicate that consumer protection rules will be equally, if not more, important post-transition than they are today, and if anything consumer protection agencies will need flexibility to ensure that current and future consumer protection rules serve the same basic social needs as they do today. In a world with new and evolving technologies but unchanging basic needs for fair practices, we must determine what the right rules are, and ensure that regulators can maintain and enforce those rules to protect all subscribers from predatory practices.

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[40] *Id.*

[41] *Id.*

[42] 47 U.S.C. § 258(a); 47 C.F.R. §§ 64.1100-64.1190.

[43] *See Verizon Complaint Regarding Unauthorized Change of Subscriber's Telecommunications Carrier*, IC Docket No. 10-S29-1-1119, Order (June 26, 2012) (denying complaint that consumer had been involuntarily switched to Verizon's FiOS service because VoIP is not covered under the slamming rules).

[44] 47 C.F.R. §§ 64.2400-64.2401; *Empowering Consumers to Prevent and Detect Billing for Unauthorized Charges ("Cramming")*, CG Docket No. 11-116, Consumer Information and Disclosure, CD Docket No. 09-158, *Truth-in-Billing and Billing Format*, CC Docket No. 98-170, Report and Order and Further Notice of Proposed Rulemaking, ¶ 47 (Apr. 27, 2012).

## Network Reliability

A comprehensive framework for the PSTN would be incomplete without a principle ensuring that the basic mechanisms of the network will continue to function throughout and after the PSTN transition, even and especially in emergency situations. Above all else, Americans rely on their communications networks to work consistently and reliably. Above all else, a successful transition means that phone numbers still work and calls still go through with the same reliability they do today.

Post-transition, there will be no "copper safety net" to offer the reliability that users have come to assume with basic phone service. Nevertheless, users' phone service—regardless of the protocols it uses—must be able to withstand emergency situations, despite current trends for less redundancy and back-up power in the system and increased reliance on the commercial power grid as a single point of failure. This emerging weakness will undoubtedly need to be addressed under the ambit of regulatory authority: companies do not always voluntarily follow best practices and internal procedures, and in any event companies will always have financial incentive to cut corners on the margins. It is therefore the role of regulators to ensure that the IP-based PSTN continues to guarantee that phone calls will go through every time a user attempts to place a call.

Recent events have called into question the reliability of IP networks as compared to traditional TDM-based systems. The FCC has already begun an inquiry into the performance of all our telecommunications networks in the wake of Hurricane Sandy,[45] and has emphasized the importance of backup power through central offices for TDM-based networks.[46] But even the basics of network reliability remain uncertain in the IP world. For example, recently AT&T experienced an outage of its U-Verse system that left tens of thousands of customers without basic phone service for days.[47] Such outages would be unacceptable in the TDM-based circuit-switched world, subject to investigation by state and federal regulators to ensure that they would not happen again. Such outages must become equally unacceptable in the IP world.

Similarly, Verizon has responded to the damage caused by Hurricane Sandy by replacing its traditional wireline voice offering with its new voice-only wireless Voice Link service.[48] Unlike Verizon's traditional service, offered over copper cables, Voice Link requires additional batteries if power is out for two days or more, as it was in the aftermath of Hurricane Sandy.[49] This type of change may not catch the attention of a customer when signing up for a service or using it during "fair weather," but could be devastating if it results in users losing access to phone service when they need it most.

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[45] Public Notice, *FCC Announces Date and Locations for the First Post-Superstorm Sandy Field Hearing*, DA 13-19 (Jan. 8, 2013), http://transition.fcc.gov/Daily_Releases/Daily_Business/2013/db0108/DA-13-19A1.pdf.

[46] *Impact of the June 2012 Derecho on Communications Networks and Services: Report and Recommendations*, Public Safety and Homeland Security Bureau, Federal Communications Commission (Jan. 2013), http://transition.fcc.gov/Daily_Releases/Daily_Business/2013/db0110/DOC-318331A1.pdf. ("The derecho experience makes clear how important it is for the provision of emergency service and reliable and resilient communications to ensure that providers maintain robust, resilient backup power in central offices, supported by appropriate testing, maintenance, and records retention.")

[47] Brian X. Chen, *AT&T's TV, Phone and Internet Service Is Down in Some States*, N.Y. Times (Jan. 23, 2013), http://bits.blogs.nytimes.com/2013/01/23/atts-tv-phone-and-internet-service-is-down-in-some-states/.

[48] Patrick McGeehan, *Wireless Home Phones: A Plan Strikes a Chord*, N.Y. Times (May 20, 2013), http://www.nytimes.com/2013/05/21/nyregion/verizon-hopes-to-nudge-some-from-wired-to-wireless.html.

[49] *Id.* The Voice Link service also does not allow users to access data services or the Internet, as the copper infrastructure had. As a result some users have had to purchase Voice Link in addition to a satellite service, or simply forgo the non-voice services they had grown accustomed to using on the wireline network. *Id.*

## Basic Network Operations

The first and most fundamental criterion for network reliability is ensuring that basic network mechanisms will continue to function during and after the network's upgrade. We must therefore determine how the fundamental mechanisms underlying the phone network today will continue to operate when the traditional PSTN technology no longer exists. The FCC currently exercises its authority over phone numbers[50] to distribute phone numbers through the North American Numbering Plan (NANP). Most VoIP providers must buy phone numbers through another carrier that uses the PSTN instead of obtaining numbers directly from a NANP Administrator.[51] This raises the stark and critical question: who will be able to obtain numbers when all carriers have transitioned to IP-based technology? How will phone numbers work in a world with no TDM-based PSTN? This is a question that we absolutely must answer if the phone network as users now know it is to continue operating post-transition.

## Reliability in Emergency Situations

Network reliability also encompasses the fundamental notion that the network must be able to withstand adverse circumstances and emergency situations while providing consistent service to those who need it. But as the PSTN moves away from independent power and increasingly relies upon the commercial power grid, it creates a common point of failure. In the newer IP-based networks, the line itself does not transmit both information and power, as the legacy PSTN originally did. This means that the network cannot rely on battery and back-up power generators from a central office, which gave the historical PSTN significant robustness.[52]

The full transition to IP protocols for the PSTN can further reduce robustness in the network. Managed network VoIP providers place electronics at the customer premises to make IP/analog conversions, and it is typically the responsibility of the customers to ensure that the backup batteries in their equipment are adequately charged.[53] This means that much of the network equipment is now dependent upon the commercial power grid, and would fail within a matter of 6-10 hours in the case of a power failure, depending upon the battery back-up power used and maintained by each individual customer.

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[50] 47 U.S.C. § 251(e)(1).

[51] The FCC is also currently considering the implications of proposals to permit VoIP providers to have direct access to phone numbers and conducting a trial for certain VoIP providers. *See Numbering Policies for Modern Communications*, Notice of Proposed Rulemaking, Order, and Notice of Inquiry, Docket No. 13-97 (Apr. 18, 2013).

[52] *See* David Gabel and Steven Burns, *The Transition from the Legacy Public Switched Telephone Network to Modern Technologies*, National Regulatory Research Institute, at 7-15 (Oct. 2012).

[53] David Gabel and Steven Burns, *The Transition from the Legacy Public Switched Telephone Network to Modern Technologies*, National Regulatory Research Institute, at 17-19 (Oct. 2012); Verizon, Backup Battery Unit (BBU) (last visited Jan. 17, 2013), http://www22.verizon.com/Support/Residential/tv/fiostv/general+support/new+to+fios+tv/questionsone/121498.htm ("The BBU is connected directly to the ONT to provide backup power if it's needed. In addition, the BBU contains a series of indicator lights that tell you whether your service is being powered by your location's electricity or the battery. The BBU also indicates when the backup battery needs to be replaced."); AT&T, AT&T U-Verse Battery Backup (last visited Jan. 17, 2013), http://www.att.com/u-verse/explore/battery-backup.jsp ("If you have AT&T U-verse services (voice, high-speed Internet, and/or TV), you must also have battery backup power for the Residential Gateway for your AT&T U-verse services to function during a power outage. AT&T will not provide support for, or be responsible for, ongoing maintenance or management of equipment, including the initial RG battery backup unit or the initial ONT backup battery provided to AT&T U-verse Voice customers.").

The impact of the transition to IP-based networks is unfolding before us in real time. After Hurricane Sandy, Verizon acknowledged that the storm caused outages in its FiOS voice, internet, and video services,[54] while users across the affected areas lined up outside to use pay phones connected to the copper network.[55] Similarly in January of 2013, customers of AT&T's U-verse voice, internet, and video services suffered outages for days due to problems with a software upgrade.[56] As one customer hit by the outage put it, "You go on U-verse, and the old handy dandy landlines that would work no matter what? . . . . That's not happening any longer."[57] This, of course, is no new phenomenon. Outages by cable providers have been periodically denying subscribers their services for years.[58]

We cannot assume that carriers will voluntarily bear the expense of building robustness in the network themselves, in particular because carriers have not always voluntarily increased their network reliability in the past. For example, one study estimated that 75% of the power-related outages from 1996 to 2003 could have been avoided if carriers had followed the best system practices established by the Network Reliability Steering Committee.[59] Moreover, the decision of how reliable a network should be in the case of emergency is a question that is more properly within the purview of the government, which can consider what requirements will best serve the public interest.

This means that the FCC, and other regulatory authorities, must determine how they can ensure that the post-transition PSTN continues to guarantee at least a minimum level of robustness, both for every day uses and in emergency circumstances, when users need communications services most. As the PSTN continues its upgrade to IP-based technology, authorities must come to terms with how they will implement rules to ensure that consumers can make calls consistently and reliably on the phone network, throughout and beyond the network's transition.

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[54] *See* Jon Brodkin, *Hurricane Sandy Also Disrupts Cellular Networks and Wired Internet*, Ars Technica (Oct. 30, 2012), http://arstechnica.com/information-technology/2012/10/hurricane-sandy-also-disrupts-cellular-networks-and-wired-internet/.

[55] *See* Abby Ellin, *Pay Phone Makes a Post-Sandy Comeback*, ABC News (Nov. 1, 2012), http://abcnews.go.com/blogs/business/2012/11/pay-phone-makes-a-post-sandy-comeback/.

[56] Brian X.Chen, *AT&T's TV, Phone and Internet Service is Down in Some States*, N.Y. Times Bits Blog (Jan. 23, 2013), http://bits.blogs.nytimes.com/2013/01/23/atts-tv-phone-and-internet-service-is-down-in-some-states/.

[57] *Id.*

[58] *See* Michelle Keahey, *Cox Cable Subscribers File Class Action Over Outages Related to Hurricane Isaac*, The Louisiana Record (Jan. 25, 2013), http://louisianarecord.com/news/248626-cox-cable-subscribers-file-class-action-over-outages-related-to-hurricane-isaac; Walter Pacheco, *Bright House Networks Fixes Cable Outage*, Orlando Sentinel (Jan. 17, 2013), http://www.orlandosentinel.com/technology/blog/os-orlando-bright-house-networks-cable-outage-20130117,0,5012652.post; Alex Sherman, *Comcast Joins Cablevision in Offering Credits After Sandy*, Bloomberg Businessweek (Nov. 2, 2012), http://www.businessweek.com/news/2012-11-02/cablevision-offers-credit-to-customers-without-power-from-sandy; Don Reisinger, *Time Warner Cable Gets Hit with 'Large' Outage*, CNET (Nov. 7, 2011), http://news.cnet.com/8301-13506_3-57319625-17/time-warner-cable-gets-hit-with-large-outage/.

[59] Kavitha Chayanam, *Analysis of Telecommunications Outages Due to Power Loss*, Master's Thesis, Ohio University, at 12, 14, 15 (2005).

## Public Safety

Finally, as agencies and legislatures have repeatedly recognized, Americans rely on 9-1-1 daily to call for help in time of need. The FCC has already begun to look to the future of public safety requirements with the Next Generation 9-1-1 transition.[60] This conversation, however, is best placed in the context of the broader context of the overall PSTN transition, both to evaluate the effect of 9-1-1 proposals on other aspects of the network, and to anticipate the impact of non-9-1-1 proposals on our emergency communications structure.

Public safety rules must be updated to ensure that emergency services like 9-1-1 and geolocation technologies continue to help first responders offer emergency care, regardless of whether the network that the customer uses is wireless or wireline, copper or fiber. The conversion to an all-IP network offers the opportunity to further facilitate emergency communications, and that opportunity must not be squandered. This also includes ensuring that the thousands of alarm systems and alarm system standards that rely on access to a "telephone line" are not disrupted by the transition.[61]

Again, in this area the FCC has relied upon its ancillary authority to require VoIP providers to provide emergency 9-1-1 calling capabilities to consumers.[62] The FCC has also subjected interconnected VoIP providers to the Communications Assistance for Law Enforcement Act (CALEA).[63] In both decisions, the FCC relied upon the fact that interconnected VoIP services offer consumers the capability of receiving calls from and making calls to the PSTN.

When the traditional architecture of the PSTN no longer exists or is no longer used, it is crucial that the FCC ensures that consumers are able to contact emergency services at the moments when they need it most. The moments in which the public relies upon emergency services like 9-1-1 are literally life-or-death, and it is crucial that the FCC implements rules that maintain the public safety components of the phone net work. To its credit, the FCC has already begun the process of creating a framework for next-generation 9-1-1 services,[64] but these issues must also be considered in the broader context of the overall shift of the PSTN to new technologies.

To the extent that the FCC has previously relied upon interconnected VoIP's connection to the PSTN, it can no longer do so when the traditional copper- and TDM-based PSTN has been retired. But letting life-saving public safety rules fade away with the old technology is not an option. We must ensure that public safety rules continue to help consumers seek help in emergency situations, regardless of the protocols used by their networks when they do so.

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[60] The FCC is also working with surer authority in this area compared to other aspects of the PSTN transition, based on the Next Generation 9-1-1 Act. *See* Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96 (2012), Title VI, Subtitle E.

[61] Professor David Gabel and Steven Burns, *The Transition from the Legacy Public Switched Telephone Network to Modern Technologies*, NRRI Report No. 12–12 (Oct. 2012) ("Starting with the 2010 code, NFPA [the National Fire Protection Association] accepts that a DACT [digital alarm communicator transmitter] can either connect to the alarm center using 'traditional copper-wire telephone service (POTS…) or by means of equipment that emulates the loop-start telephone circuit and associated signaling and then transmit[s] the signals over a pathway using packet-switched (IP) networks or other communications methods that are part of an MFVN [managed facilities-based voice network].' . . . The 2010 Fire Alarm and Signaling Code illustrates how historically standards, regulations, building codes, and business practices were written on the presumption that the legacy PSTN would be used to transmit information.").

[62] *IP-Enabled Services*, First Report and Order and Notice of Proposed Rulemaking, 20 FCC Rcd. 10,245 (2005), *aff'd sub nom. Nuvio Corp. v. FCC*, 473 F.3d 302 (D.C. Cir. 2006) (requiring interconnected VoIP providers to offer emergency 9-1-1 calling capabilities).

[63] *Communications Assistance for Law Enforcement Act and Broadband Access and Services*, ET Docket No. 04-295, RM-10865, First Report and Order and Further Notice of Proposed Rulemaking, 20 FCC Rcd,14,989, 14,991-92, ¶ 8 (2005), *aff'd, American Council on Education v. FCC*, No. 05-1404 (D.C. Cir. June 9, 2006).

[64] *See, e.g.*, *Facilitating the Deployment of Text-to-9-1-1 and Other Next Generation 9-1-1 Applications*, PS Docket No. 11-153, *Framework for Next Generation 9-1-1 Deployment*, PS Docket No. 10-255, Further Notice of Proposed Rulemaking (Dec. 12, 2012).

## The Role of Federal and State Authorities

The actual work of implementing policies based on the Five Fundamentals discussed above relies on authorities in all levels of government. This means that, in addition to federal authorities like the FCC, state and local regulators will have an important role to play in the phone network transition. State and local regulators have long played a vital role to the governance of the phone network, and they should continue to do so as carriers update their network technology.

The Communications Act explicitly recognizes and delineates the role of state and local governments in overseeing the proper functioning of the phone network. For example, section 214 grants state commissions the authority to designate eligible telecommunications carriers and delineates authority between interstate services and intrastate services.[65] State and local governments also retain authority over aspects of pole attachments,[66] commercial mobile services,[67] and preventing harassing phone calls,[68] among many other duties. But the states' authority over important aspects of the phone network could potentially be jeopardized if the FCC takes steps to preempt state authority over phone service simply because it is delivered via new technological protocols.

For example, in 2004, the Commission preempted an order from the Minnesota Public Utilities Commission that applied phone regulations to Vonage's interconnected VoIP service, but did not classify interconnected VoIP as either a telecommunications or information service.[69] As managed VoIP services become increasingly prevalent and the older TDM-based phone services fade away, the question inevitably arises of what regulatory authority remains with state authorities and where state authorities are best suited to craft, implement, and enforce rules that will achieve the most benefits for consumers and competition.

Even beyond state and local governments' expertise in and sensitivity to the needs of their respective geographic regions, state and local government also take on a tremendous administrative burden as a matter of day-to-day business. If the states are preempted by federal regulation and no longer play a role in governing the phone network, it will be the FCC's sole responsibility to handle all of the interconnection issues, 9-1-1 administration, and consumer complaints—from billing to quality of service to fraudulent practices—that state and local governments currently handle every day. The FCC should not, and likely could not, absorb the influx of work that would come hand-in-hand with bypassing state and local governments, which is on its own reason enough to continue to recognize their vital role in governing the network.

State and local governments play an important role in the governance of the phone network, as is already recognized by the Communications Act. Even as the network's technology transitions and specific rules may change, state and local governments will still be the best suited to make locally-focused decisions and handle locally-based complaints. Our phone network policies must therefore implement the values of the Five Fundamentals while acknowledging the appropriate role of state and local governments in governing the network.

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[65] 47 U.S.C. § 214.

[66] 47 U.S.C. § 224.

[67] 47 U.S.C. § 332(c)(3).

[68] 47 U.S.C. § 223(f)(2).

[69] *Vonage Holdings Corporation Petition for Declaratory Ruling Concerning an Order of the Minnesota Public Utilities Commission*, WC Docket No. 03-211, Memorandum Opinion and Order, 19 FCC Rcd. 22,404 (2004).

# Conclusion

The ongoing transition of the phone network presents challenges, opportunities, and a myriad of unanswered questions for the future of communications service in the U.S. The first step to answering those questions is establishing a broad framework that sets out the fundamental goals of our communications policy. The Five Fundamental principles of service to all Americans, interconnection and competition, consumer protection, network reliability, and public safety are chosen to create a comprehensive picture of the values that made 20th Century phone service in the U.S. such a wild success. Now that the conversation has turned to the communications infrastructure of the 21st Century, we find that the nation's basic needs remain the same, and so these fundamentals continue to be vital to guiding the policy decisions that lie ahead.

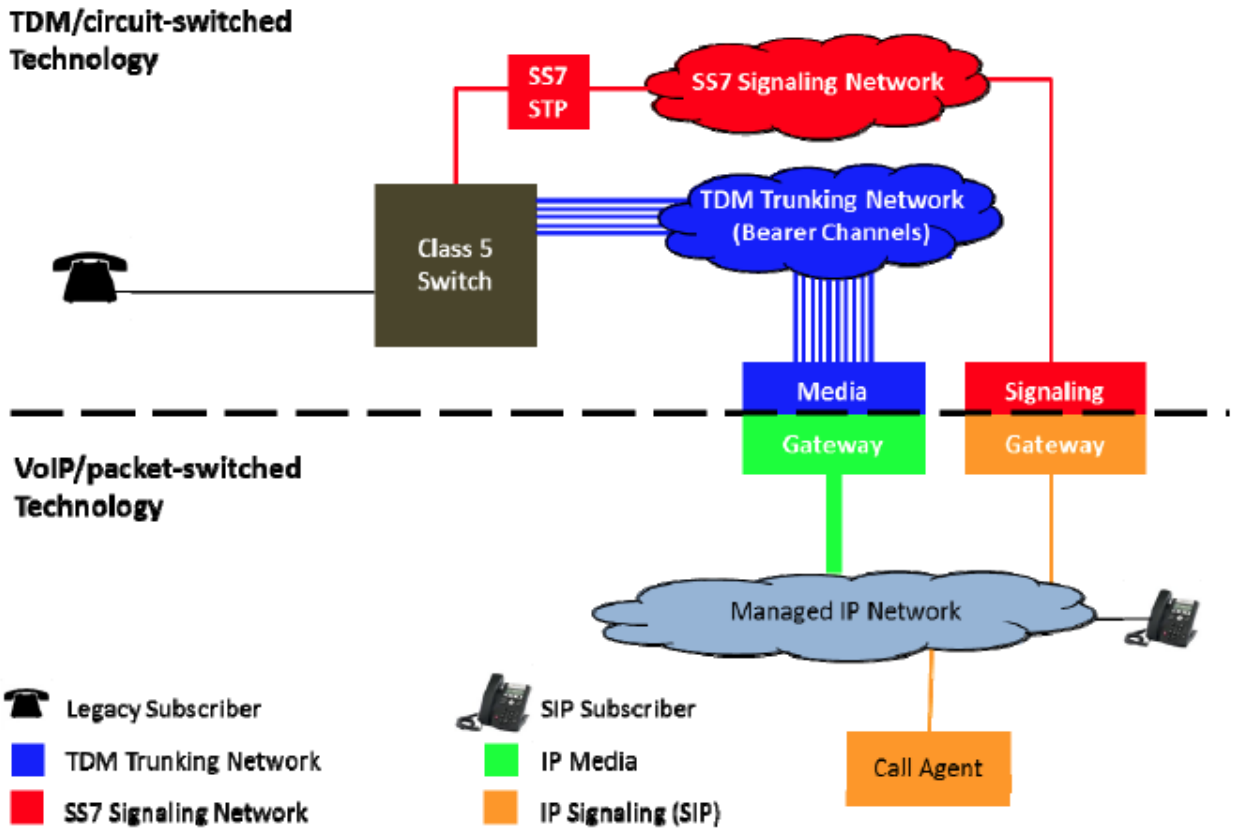
# Appendix

A brief overview of the architectural changes involved in VoIP-to-TDM or managed VoIP-to-managed VoIP interconnection demonstrates how the introduction of IP to the PSTN does not radically change the nature of the services being rendered. IP interconnection varies in some ways from TDM interconnection, but the essential nature and purpose of the process remains unchanged.

The Regulatory Research Institute has published a very thorough and useful paper explaining the technical architecture of interconnection in the transition to IP, written by Joseph Gillan and David Malfara.[70] What follows will be a very brief summary comparing IP interconnection to interconnection using older TDM-based technology.

Today, VoIP interconnection often requires the VoIP call to be converted into a TDM call at the boundary between the IP network and the circuit-switched network. Figure 1 portrays a VoIP-to-TDM interconnection configuration. This type of interconnection requires that both the media stream and signaling information be interconnected, which is why Figure 1 shows two points of interconnection between the networks at gateways, which handle the protocol conversions.

**Figure 1: VoIP-to-TDM Interconnection**



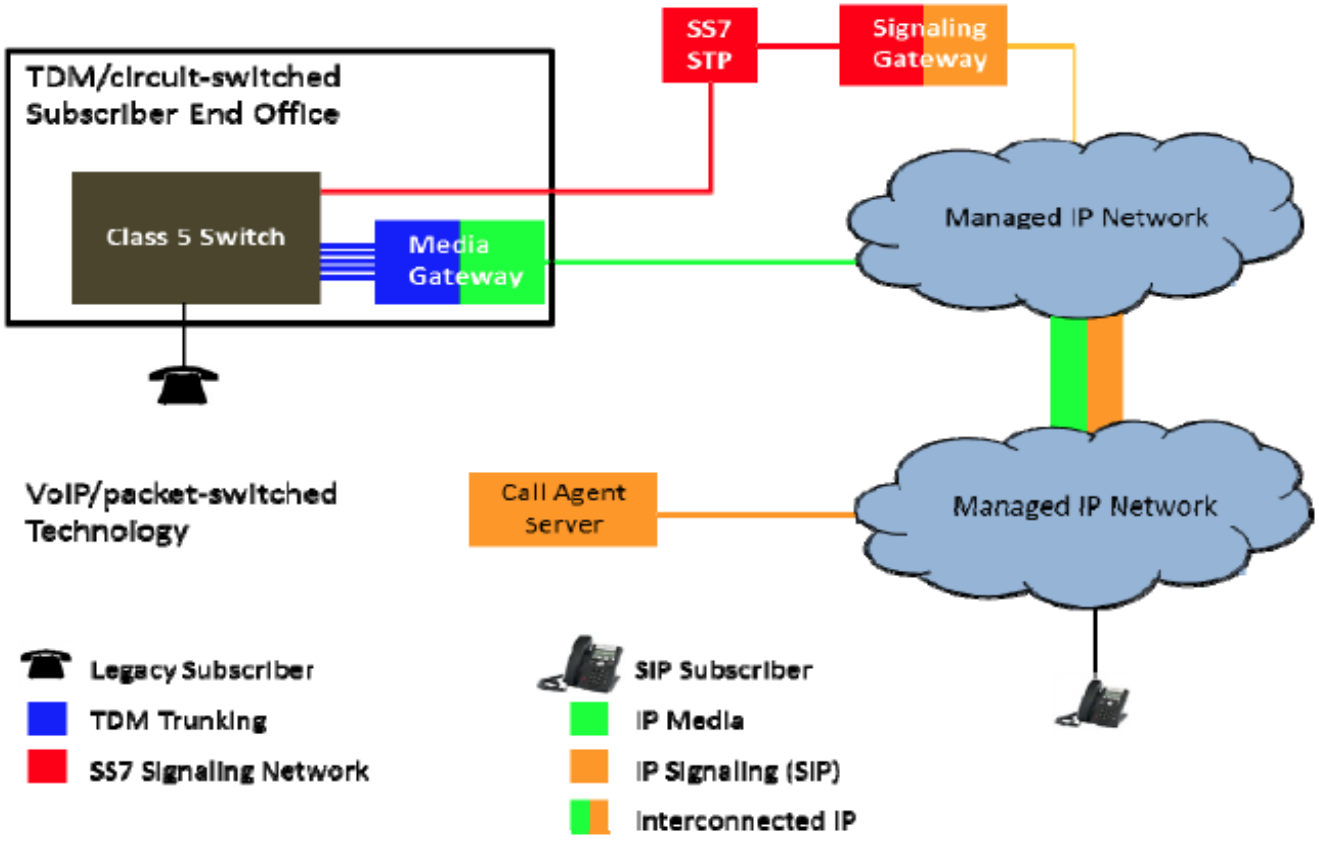

[70] Joseph Gillan and David Malfara, *The Transition to an All-IP Network: A Primer on the Architectural Components of IP Interconnection*, National Regulatory Research Institute (May 2012).

[71] *Id*. at 9. All images reprinted with permission.

IP-to-IP interconnection is possible even if one of the networks involved is a TDM-based network (for example, an ILEC with an IP transport network may still serve some users from a TDM switch). In this situation, the TDM-based network will convert its TDM signal to IP before the signal reaches the boundary between the networks. In Figure 2, the media stream (the conversation) is converted at the same physical location as the Class 5 switch. Note that this process functions very similarly if both networks are TDM-based networks using IP interconnection. In that case, the interconnection would look identical to Figure 2, but both sides would have call agents and both sides would have the gateways you see in the top half of Figure 2.
[72]

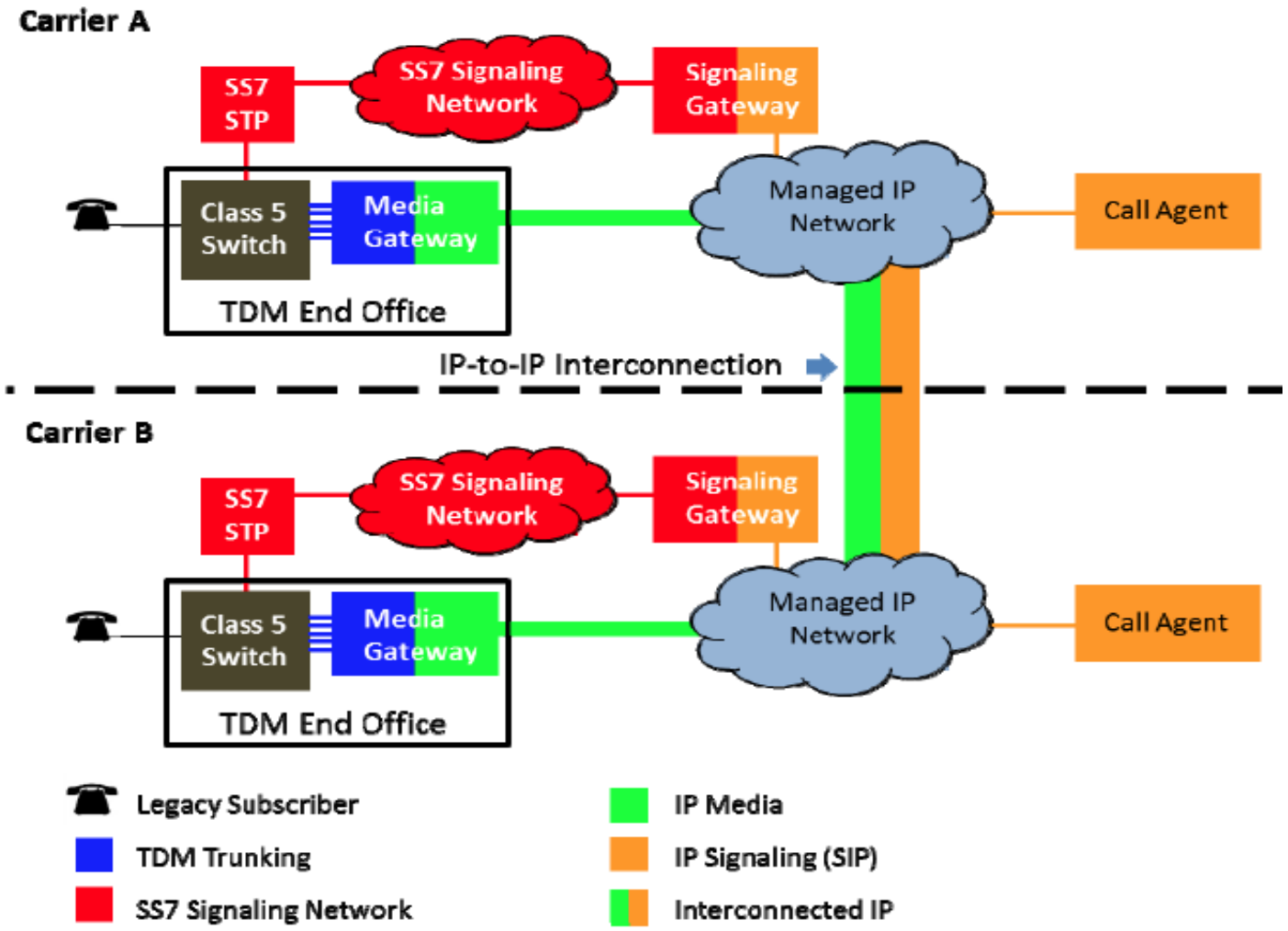
If both networks use IP-based technology and IP interconnection, the networks will exchange media and signaling through IP directly between their managed IP networks. The network's signaling connection for each call is replaced by external servers that are accessed using Session Initiation Protocol (SIP), which sets up and ends the calls, in addition to call maintenance, redirection, and other functions. Figure 3 reflects IP-to-IP interconnection with VoIP end points on both ends.

**Figure 2: IP-to-IP Interconnection with VoIP/TDM End Point**




[72] *Id.* at 12.

**Figure 3: IP in the Middle (with End Points TDM)**




[73]

The physical differences between the architecture of TDM-to-TDM, TDM-to-IP, and IP-to-IP interconnection emphasize how the introduction of IP-based technology does not radically change the nature of the relationships between the networks. If anything, IP-to-IP interconnection offer potential efficiencies that could be seized as opportunities for better services and more choices for consumers, if conducted under an appropriate policy framework. Ultimately, an examination of the network architecture of IP interconnection only emphasizes the broader point that this transition does not radically alter the dynamics of the agreements struck between carriers or the type of service offered to consumers—although technology may allow them to achieve more with that service. As a result, the social goals of our communications infrastructure remains the same, even as the network evolves into the next iteration of the PSTN.

[73] Id. at 12.